

# An Observational Study on Etiological, Clinical and Prognostic Profile in Acute Kidney Injury Patients Admitted in an Intensive Care Unit

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**Abstract:** *Background:* Acute Kidney Injury (AKI) is defined as an abrupt (1 to 7 days) and sustained (more than 24 hours) decline in kidney function, which includes both anatomical and functional impairment, resulting in retention of nitrogenous and other waste products, dysregulation of fluid, electrolyte and acid - base homeostasis<sup>1</sup>. AKI is basically preventable to a large extent and is potentially reversible if diagnosed and treated early. The present study was done with an intention of evaluating etiological, clinical and prognostic profile in AKI patients admitted in ICU. Thereby, improving early diagnosis, treatment and outcome. *Materials and Methods:* This descriptive observational study was conducted in the intensive care unit of a tertiary hospital to study the etiological, clinical and prognostic profile in acute kidney injury patients. Purposive sampling method was done and a total of 180 patients were included in this study which was performed over 18 months from January 2020 to July 2021. *Results:* In ICU, AKI is skewed towards male, and most common in elderly patients. Prognosis is poor when associated with co morbid conditions. Most common aetiologies were sepsis and MODS (multi organ dysfunction syndrome) which resulted in poorer outcome. Mortality rate among AKI was in increasing trend from risk to failure. The RIFLE criterion was found to be a good predictor for recovery of renal function. *Conclusion:* AKI attributes to major cause of morbidity, mortality and financial burden worldwide in developing countries. Many prospective and retrospective studies showed that the incidence of AKI is rapidly increasing, particularly among patients admitted in intensive care unit. Significant associations were noted between age, comorbid conditions, clinical presentations and mortality in patients admitted to intensive care unit

**Keywords:** Acute kidney injury, MODS, sepsis

## 1. Introduction

Acute Kidney Injury (AKI) is defined as an abrupt (1 to 7 days) and sustained (more than 24 hours) decline in kidney function, which includes both anatomical and functional impairment, resulting in retention of nitrogenous and other waste products, dysregulation of fluid, electrolyte and acid - base homeostasis.

For many years in clinical practice, the terms ATN and ARF were used interchangeably. But in the recent years, the concept of Acute Renal Failure (ARF) has undergone significant changes and has been replaced by AKI. The term ARF is now restricted to AKI patients who need renal replacement therapy (RRT)<sup>2</sup>. Recent evidence suggests that even mild impairment of renal function with small changes in serum creatinine (sCr) or mild decline in urine output is a predictor of serious clinical consequences and is termed as AKI. AKI is no longer considered to be an innocent bystander merely reflecting coexistent pathologies. AKI is considered as a syndrome with mixed aetiology of sepsis, Ischemia and nephrotoxicity, which makes diagnosis difficult and delays treatment<sup>3</sup>. However, kidney is one of the few organs of the body which has the ability to undergo complete recovery after injury. This feature stresses the importance of early diagnosis and management of AKI, thereby preventing further deterioration of renal function. It has been postulated that kidney is a source of stem cells as evident by renal function recovery following kidney injury due to vascular and toxic injury, where epithelial cells of

proximal and distal tubules undergo dedifferentiation and proliferation leading to regeneration and recovery of renal function<sup>4</sup>. AKI occurs in approximately 7% of all hospitalised patients and in up to 36% to 67% of critically ill patients. Despite advances in therapy, AKI complicates about 5% of hospital admissions and 30% of admissions to intensive care unit (ICU) particularly in the setting of diarrhoea, malaria, leptospirosis and sepsis<sup>5</sup>. AKI - specific severity of illness scoring systems has been validated to determine prognosis in ICU cases<sup>6</sup>. AKI is considered as an independent and significant predictor of in - hospital death. There by stresses the importance of early diagnosis and prompt treatment to improve outcome. The present study was done to evaluate clinical profile and outcome in AKI patients admitted in ICU.

## 2. Materials and Methods

The present study was an observational, descriptive study conducted in intensive care unit, department of general medicine, PESIMSR, KUPPAM during January 2020 to July 2021. Patients who were admitted in general medicine ICU, at PES Institute of Research and Medical Sciences, Kuppam, fulfilling KDIGO criteria, satisfying the inclusion and exclusion criteria were studied. Following investigations comprising haematological and biochemical were done depending on the patients profile. Complete blood picture, urine analysis, blood urea, serum creatinine blood glucose, liver function tests, chest X - ray and ultrasound abdomen and pelvis were done. Additional investigations were done

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as and when required. All results of each patient were recorded in structure pro forma.

#### Inclusion Criteria:

- 1) Patients above 18 years of age.
- 2) Admitted to the ICU with the diagnosis of AKI.
- 3) Patients who developed AKI during hospitalisation.

#### Exclusion Criteria:

The patients with chronic kidney failure, organ donors, who underwent kidney transplantation, on chronic dialysis and had incomplete medical record were excluded from the study.

#### Statistical Analysis:

The data collected was analysed using descriptive statistics in the observational study, descriptive statistics like percentages, central distributions, standard deviations etc., were used to describe the results. The differences in proportions were tested for statistical significance by using chi - square test. p value less than 0.05 was considered as significant. The data was analysed using SPSS ver 22.0 (SPSS Inc., Chicago, USA) Windows software program

### 3. Results

Total number of patients who fulfilled criteria - 168

Total number of cases excluded from study - 32

#### Demographic Data:

For all the patients (n = 136), demographic data was analysed. Of the 136 patients, 88/136 (64.7%) were male and 48/136 (35.3%) were female. Male to female ratio was 1.8: 1. Mean age of n= 136 patients is 49.82 years with mean age of females 49.47 years and males was 50 years with no statistically significant difference between males and females (p value > 0.05).

**Table 1:** Demographic data and clinical features

Demographic Data	No. of Patients	Percentage
<b>AGE</b>		
Male	88	64.70%
Female	48	35.30%
Age		
<b>Clinical Features</b>		
Fever	52	38.20%
Generalized weakness	38	27.90%
Vomiting, diarrhoea	27	19.80%
Abdominal pain	12	8.80%
SOB	15	11.00%
confusion	22	16.10%
Burning micturition	13	9.50%
Edema	11	8.00%
Oliguria	24	17.60%
Anuria	16	11.70%
Hyperkalemia	36	26.40%
Metabolic acidosis	41	30.10%

**Table 2:** Age Incidence and Mortality and distribution of patients according to etiology and outcome

Age incidence and associated mortality	No.	Percentage	Mortality	Percentage
<20	3	2.20%	1	7.60%
21 - 30	16	11.70%	1	7.60%
31 - 40	23	16.90%	2	15.30%
41 - 50	19	13.90%	1	7.60%
51 - 60	28	20.50%	3	23%
>60	47	34.50%	5	38.40%
Distribution of patients according to etiology and outcome				
ETIOLOGY	No.	Percentage	Mortality	Percentage
MEDICAL	114	83.80%	10	77%
VHF	28	20.50%	2	15.30%
Pneumonia	12	8.80%	1	7.60%
Malaria	19	13.90%	1	7.60%
UTI	16	11.70%	1	7.60%
Acute GE	29	21.30%	3	23%
Snake bite	5	3.60%	2	15.30%
Leptosira	3	2.20%	0	0%
Rickettesia	2	1.40%	0	0%
Medico - Surgical	22	16.20%	3	23%
Acute pancreatitis	9	6.60%	1	7.60%
Obstructive uropathy	4	2.90%	0	0%
Snake bite with cellulitis	5	3.60%	1	7.60%
Perforation peritonitis	3	2.20%	1	7.60%
Postpartum bladder atonia	1	0.70%	0	0%
TOTAL	136	100%	13	100%
Distribution of Patients according to Comorbidities and Mortality				
Comorbidities	Number	Percentage	Mortality	Percentage
Type 2 DM only	21	15.40%	2	15.30%
Hypertension only	14	10.20%	1	7.60%
CAD only	8	5.80%	0	0%
DM +HTN	12	8.80%	3	23%
DM+CAD	6	4.40%	2	15.30%
HTN+CAD	3	2.20%	1	7.60%
DM+HTN+CAD	1	0.70%	1	7.60%
NONE	71	52.50%	3	23.10%
Association between Types of Renal Failure and Mortality				
Renal Failure	Number	Percentage	Mortality	Percentage
Pre renal	39	28.60%	2	15.30%
Intrinsic	88	64.70%	10	76.90%
Post renal	9	6.60%	1	7.60%

### 4. Discussion

AKI is a major problem encountered in critical care settings. Many prospective and retrospective studies showed that incidence of AKI is rapidly increasing, particularly among patients admitted in intensive care.

In our study a total of 168 AKI patients fulfilling KDIGO criteria, admitted to intensive care unit at PES Medical college, Kuppam between January 2020 to July 2021 were analysed and 32 were excluded as some patients were discharged against medical advice and some died within one day of admission and finally 136 cases were taken into the study. In a prospective observational study done by Paudel et al., among 100 ICU patients in New Delhi, India showed that the incidence of AKI is 17.3 cases per 100 person years<sup>7</sup>. In an international study conducted by Joannidis et

al. involving 16, 784 ICU patients, the prevalence of AKI was 28.5% using the AKIN criteria and 35.5% using the RIFLE criteria<sup>8</sup>.

In our study, mean age of the patients was 49.82 years and male to female ratio was 1.8: 1. Sex ratio was skewed more towards males being 88 (65%). Incidence of kidney disease is higher among males, also the progression of AKI is more rapid in males. This is attributed to androgens, which are considered as risk factor for glomerular injury<sup>9</sup>. Also oestrogen's are known to exert protective role in females, where they may indirectly regulate the synthesis of vasoactive agents, cytokines, and other growth factors. They also known to have a role in extracellular matrix metabolism. Additionally, oestrogen's increase nitric oxide synthase enzyme activity and antioxidant synthesis<sup>10</sup>. However, the KDIGO guidelines, stated that females are susceptible to the development of hospital - sourced AKI.

The results of our study showed the mean age of the patients admitted to ICU in as 50years with maximum number of the patients (47 i. e., 34.5%) in the age group >60years. Mortality rate was also highest in the older age group >60 years (38.4%),

The reason for the incidence of AKI in elderly is explained by anatomical and physiological changes that occur in the kidneys as the people age. Nephron mass reduces, vascular and glomerular degeneration develops at a microscopic level and the tendency toward cellular apoptosis increases<sup>11</sup>. Therefore GFR is reduced majority of the cases of our study, 114 (83.8%) were due to medical conditions and rest 22 (16.2%) cases were due to surgical and obstetrical causes.

Mortality rate in our study was 9.5% and medical causes resulting in death was highest contributing to 77% of overall mortality and medico - surgical cases resulted in rest 23%<sup>12</sup>.

Majority of patients with AKI had preexisting comorbidities like type 2 diabetes, hypertension, coronary artery disease. These findings are in concordant with a review that there is significantly increased risk of AKI in critically ill patients with diabetes, hypertension, heart failure and nephrotoxic drugs abuse<sup>13</sup>. Results of our study also showed comorbidities in 47.5% of patients with type 2 diabetes mellitus being the most common associated comorbidity. Other commonly associated comorbidities in our study were coronary artery disease and Hypertension. Mortality rate was highest among patients with comorbid conditions (76.9%) compared to patients with no comorbidities (23.1%) with highest mortality seen among the diabetic group. This was 60% among total expired cases.

The most common complaints in our study were fever and generalised weakness seen in 38.2% and 27.9% cases respectively and most common presenting features were Metabolic acidosis (30.1%) and hyperkalemia (26.4%).

In our study, out of 136 patients, 17% patients had oliguric renal failure and 12% had anuric renal failure. Rest of AKI had non oliguric renal failure<sup>14</sup>.

Most common complications of AKI were sepsis, hypotension, MODS, GI haemorrhage and pulmonary

oedema. In our study, sepsis was the most common complication seen among 56 patients (41.1%), followed by MODS in 48 patients (35.2%) and hypotension in 42 patients (38.4%). Several factors have emerged as predictors of sepsis developing after AKI diagnosis such as oliguria, oedema of soft tissue and gut, prior abuse of steroids, invasive non - surgical procedures performed after the diagnosis of AKI, independent of the provision of dialysis. In our study, mortality was highest in MODS patients, which was seen in 9 patients constituting 69.2% of mortality rate followed by sepsis (46%). In our study, hypotension was seen in 30.8% patients with 11.9% mortality rate<sup>15</sup>.

Results from multivariate logistic regression indicate that both severity and duration of hypotension are significant risk factors for AKI in ICU. AKI increases by 3% per every 1 mmHg decrease in MAP below 80 mmHg. The need for ventilation was associated with higher mortality. In our study 10.2% of the patients needed mechanical ventilation and the mortality in ventilated patients was 84.6 %. In our study of 136 AKI patients, 101 (74%) cases had conservative management and rest 35 (26%) had hemodialysis, out of which 4 (30.7%) cases and 9 (69.2%) cases expired in each group respectively. In our study of 136 AKI cases, 86 (63.2%) Cases had complete recovery, 37 (27.2%) cases progressed to CKD and 13 (9.5%) cases expired. out of these 35 (94.5%), 36 (85.7%) and 15 (26.3%) of patients in Risk, Injury and failure class had complete recovery. 1 (2.8%) of risk, 3 (7.1%) Injury and 9 (15.7%) of Failure group were expired<sup>16</sup>.

## 5. Conclusion

In our study of 'Etiological, clinical, prognostic profile and outcome in patients with acute kidney injury in intensive care unit', following conclusions were made.

- 1) AKI had more male preponderance with more incidence among higher age group.
- 2) Mortality rate was highest among age group > 60.
- 3) AKI was multifactorial with major incidence of medical related AKI than medico - surgical cases.
- 4) Mortality was more in medical cases than medico - surgical cases.
- 5) Comorbid factors can play a role in final outcome of AKI, where Type 2 diabetes mellitus had the highest mortality among the comorbid illnesses.
- 6) Most common presentation was metabolic acidosis and hyperkalemia.
- 7) Mortality of patients of AKI in the ICU in our study was 9.7%.
- 8) In the setting of ICU despite of adequate management MODS, respiratory failure and sepsis were the major causes of mortality in these patients.
- 9) Among the risk, injury and failure groups, maximum number of patients from the failure group progressed to CKD and also had major death rate

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